The impact of the introduction of broker anonymity on the New Zealand Exchange

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Abstract:

This paper examines the impact of the introduction of anonymous trading on the New Zealand Exchange (NZX) in late July 2007. We find that the change in market architecture yielded modest benefits. Bid/ask spreads on stocks initially increased following the introduction of anonymous trading, but then declined and eventually fell below the pre-anonymity levels, most notably for medium-cap stocks. We estimate the benefit of the decreased spreads faced by liquidity demanders at $1.7 million per $25 billion of turnover. However, we find only limited evidence that the NZX gained market share in cross-listed stocks following the introduction of anonymous trading.

1. Introduction

In late July 2007 the New Zealand Exchange (NZX) adopted anonymous trading for listed stocks by removing broker identifiers. The NZX suggested that this would improve market liquidity in NZX-listed stocks and halt the migration of trading in cross-listed stocks to the Australian Stock Exchange (ASX). This paper examines the impact of this switch to anonymous trading on the bid-ask spread of NZX-listed stocks and the NZX share of trading in cross-listed stocks.

This research is important for several reasons. First, it is important to document whether or not the adoption of anonymity has yielded the expected benefits. That is, has market liquidity increased and has the migration of trading activity in cross-listed stocks been reversed? This evidence should be of interest to the NZX and its stakeholders. Second, the empirical literature has not reached a consensus on the effect of the introduction of anonymous trading on other stock exchanges. While univariate analysis and ordinary least squares (OLS) regression analysis show strong evidence that the switch to anonymity improves market liquidity (see Comerton-Forde et al., 2005; Foucault et al., 2007; Comerton-Forde and Tang, 2009), methods that seek to deal with the endogeniety problem come to the opposite conclusion (see Maher et al, 2008). We use a number of estimation techniques to provide a comprehensive analysis of the impact of anonymity on market liquidity. Third, the switch to anonymity runs counter to the argument that disclosure of both pre-trade and post-trade information should be mandatory as it creates a more level playing field between informed and uninformed investors (Fishman and Hagerty, 1995). While institutional investors might prefer an opaque environment where trader identities are not disclosed, it is by no means clear that this is to the advantage of retail investors (see SEC, 2000).

Using data on stocks comprising the NZX50 Index, we find that bid/ask spreads are higher following the introduction of anonymous trading. This is confirmed by OLS regression analysis which seeks to control for changes in the known determinants of bid/ask spreads. This result is robust to the use of fixed effects OLS and two-stage least squares (2SLS).

However the rise in spreads is weaker the wider the sample period centred on the introduction of anonymous trading, suggesting that the impact on spreads is time-varying. Further analysis shows that although spreads rise in the first 20-day period following the switch to anonymous trading, this increase disappears during the next 20-day period and that by the end of the third 20-day post-event period spreads are below the level that prevailed during non-anonymous trading, with the decline most pronounced for the sample of mid-cap stocks.

We find only weak evidence that the switch to anonymous trading increases the NZX's share of on-market trading volume in NZX-listed stocks that are cross-listed on the ASX. Overall, our results suggest that the introduction of anonymous trading on the NZX yielded modest benefits for investors and the NZX.

The remainder of the paper is structured as follows. Section 2 discusses the adoption of anonymous trading by the NZX in more detail, reviews the relevant theoretical and empirical literature and develops several testable hypotheses. Section 3 discusses the sample and data. The results are presented and discussed in Section 4. Section 5 concludes.

2. Theoretical development

2.1 Background

On July 27, 2007 the NZX introduced anonymous trading for all stocks quoted on the NZSX. Henceforth, the identity of the broker placing an order on the NZSX would not be disclosed to other market participants until two business days following completion of the trade. The motives behind the introduction of anonymous trading included encouraging market participation, improving liquidity and enhancing the NZX's competitiveness against the ASX, which was readily available as an alternative listing venue for many NZX-listed companies and which had adopted anonymous trading several years earlier. The ASX's adoption of anonymous trading was regarded as a contributing factor in the continued migration of trading in cross-listed stocks from the NZX to the ASX.

2.2 Hypothesis development

It has been conventional wisdom over recent decades for exchanges to mandate increasing levels of disclosure of both pre-trade and post-trade information, reflecting the view that greater transparency creates a more level playing field between informed and uninformed investors (Fishman and Hagerty, 1995). However it has also become increasingly clear that large traders such as institutional investors prefer that their identity be hidden from other market participants while they execute the multiple trades necessary to fill a large order (SEC, 2000). This has led a number of exchanges to amend their trading protocols to provide greater anonymity to market participants. Removing broker identification codes from publicly-displayed orders or recently executed trades are examples of this move to greater anonymity.

Revealing broker identification codes for publicly-displayed orders and recently executed trades provide valuable information to market participants because this may help identify the client for whom the broker is acting and thus whether the order or

trade is likely be informed or uninformed. In a transparent market, a separating equilibrium will emerge, whereby liquidity suppliers will charge informed traders a higher bid-ask spread than uninformed traders. In an anonymous market, however, liquidity suppliers will find it difficult to determine when an order is informed or uninformed. As a result, they will pool all orders and charge both informed and uninformed traders a common bid-ask spread (Beneviste et al., 1992). In this simple framework, the adoption of anonymous trading will reduce bid-ask spreads for informed traders but at the expense of higher bid-ask spreads for uninformed traders. If the volume of both informed and uninformed trading is sensitive to trading costs, these changes in spreads encourage trading by informed but discourage trading by uninformed traders. The microstructure suggests that the resulting overall rise in the ratio of informed to uninformed traders will put upward pressure on bid-ask spreads (Easley et al., 1996).[1]

On the other hand, it has been argued that anonymous trading should reduce bid/ask spreads by encouraging the submission of more aggressive limit orders. Anonymity should allow liquidity providers to quote more aggressively as they can avoid punishment by other liquidity providers who would prefer that spreads be set collusively (Simaan et al., 2003). In addition, informed traders no longer need to engage in bluffing when submitting limit orders to disguise the information they possess and prevent free-riding by uninformed traders, allowing them to post more competitive quotes (Foucault et al., 2007).

[1] One could also argue that the introduction of anonymous trading will widen spreads because traders will be less aggressive in the placement of their orders. For example, informed traders will not be in such a hurry to execute their orders so favour limit orders rather than market orders. Anonymous trading will make it difficult for uninformed investors to engage in front-running, dampening their order aggressiveness. Duong et al. (2008) finds supporting evidence following the switch to anonymous trading on the ASX: order aggressiveness of both institutional and individual investors declines following the adoption of anonymous trading.

A number of empirical studies have examined the impacts of the switch to anonymous trading that has occurred on several exchanges in recent years. The exchanges that have adopted anonymous trading include Euronext Paris (April, 2001), the Tokyo Stock Exchange (June, 2003) and the Australian Stock Exchange (November, 2005). Univariate analysis shows that the switch to anonymous trading is associated with a decline in bid-ask spreads (see Comerton-Forde et al., 2005; Foucault et al., 2007; Comerton-Forde and Tang, 2009). OLS regression analysis confirms that bid-ask spreads declined after controlling for changes in other determinants of the spread such as the level of stock prices, trading volume and stock price volatility. These studies provide strong evidence that the switch to anonymous trading on these exchanges has improved market liquidity. However Maher et al. (2008) argue that the regression analysis employed in these studies suffers from the endogeneity problem. They show that 2SLS yields the opposite finding i.e., the switch to anonymity is associated with a widening of bid-ask spreads.

Given the mixed nature of both theoretical and empirical results, our first hypothesis, stated in the null form, is:

H1: The introduction of anonymous trading will have no effect on the bid/ask spreads of NZX-listed stocks.

Our second hypothesis concerns the impact of anonymity on the competitiveness of the NZX. One of the potential motives behind the move to anonymity was the NZX's desire to halt the migration of both order flow and listings from the NZX to the ASX. It is presumed that pressure from institutional investors lay behind the decision to adopt anonymous trading since large investors stood to gain the most from such a change. Given that we can expect trading activity by institutional (i.e. informed) investors to be

more sensitive to reductions in trading costs such as market impacts costs than trading by uninformed investors, we should expect to witness an overall increase in on-market trading activity on the NZX relative to that on the ASX.[2] Thus our second hypothesis, in the null form, is:

H2: The introduction of anonymous trading will have no effect on the market share of the NZX in trading volume in cross-listed stocks.

3. Sample and Data

3.1 Sample

To test our two hypotheses we focus on the constituent stocks in the NZ50 Index on July 27, 2007. We eliminate stocks from this initial sample if there primary listing is on the ASX rather than the NZX since trading volumes on the NZX will be minor compared to those on the ASX. This eliminates nine stocks from the sample. Table A1 in the Appendix presents a full list of the 41 stocks in the final sample and the nine stocks excluded. The 41 stocks in the final sample represent over 90% of the NZ50 index in terms of market capitalization. As the degree of information asymmetry differs between small stocks and large stocks (Hasbrouck, 1991; Easley et al., 1996), we partition our sample into three sub-samples based on market capitalisation. The large-cap subsample comprises the 13 stocks with a market capitalisation above $1,500 million. A small-cap subsample comprises the 15 stocks with a market capitalisation below $500 million. The medium-cap subsample comprises the remaining 13 stocks from the with a market capitalisation between $500 million and $1,500 million.

[2] As trading costs fall, the net benefits from the acquisition of private information will rise, encouraging the level of private information production and hence the level of informed trading.

3.2 Sample period

As prior studies report some inconsistent findings for sample periods of varying length around the change in anonymity (Comerton-Forde et al., 2005) we employ three sample periods centred on the switch to anonymous trading: (i) a sample period from May 3, 2007 to October 18, 2007 (denoted [-60,+60]), (ii) a sample period from May 31, 2007 to September 20, 2007 (denoted [-40,+40]), and (iii) a sample period from June 29, 2007 to August 23, 2007 (denoted [-20,+20]). Later we also partition the 60-day post event period into three shorter 20-day periods to help determine if market participants learn from their early experiences with anonymous trading and modify their trading strategies.

3.3 Data and variables

Intraday price and quote data on the NZ50 stocks is obtained from the Securities Industry Research Centre of Asia-Pacific (SIRCA). SIRCA also provide data on daily trading volumes in cross-listed stocks on the ASX. Data on the issued capital of NZSX 50 stocks are obtained from NZX Data.

We use the daily percentage bid/ask spread, measured by the relative time-weighted average bid/ask spread divided by the time-weighted price, as our measure of liquidity.[3] Following prior research, we collect daily data on a number of variables known to influence bid/ask spreads for inclusion in our multivariate analysis. These variables include stock price, stock price volatility and trading activity variables. We include the stock price since prior research shows that the percentage bid/ask spread is an inverse function of the stock price due to tick size effects on low-price stocks (Harris, 1994).

[3] Order-based measures of liquidity such as percentage bid/ask spread provide more reliable estimates of changes in liquidity than trade-based measures (Aitken et al., 2003).

Intraday volatility, computed as the daily average of the differences between the logarithms of the daily highest and lowest stock prices, is employed as our measure of stock price volatility. This extreme value volatility estimator is likely to be more efficient than estimators based on closing prices when a stock is frequently traded (Wiggins, 1992). Last, the volume of shares traded is used as our principal measure of trading activity.

4. Empirical results

4.1 Bid/ask spreads

4.1.1 Univariate analysis

Table 1 reports summary statistics on the percentage bid/ask spread and other key variables in both the pre-event and post event periods for the widest sample period [-60,+60]. The results for the full sample show an increase in the bid/ask spread that is significant at the 0.001 level under both the *t*-test and the Wilcoxon signed rank test.[4] For example, the mean spread increases from 0.0081 to 0.0090, a rise of 0.0009 or 0.09%. The increase in volatility and the decrease in stock prices following the switch to anonymous trading are significant. When we partition the sample into the three capitalisation-based sub-samples, we find that the increase in spreads is concentrated in the small-cap sample while volatility increases all three sub-samples. Price reductions appear to be concentrated in the medium-cap and small-cap samples.

[insert Table 1 here]

[4] We place more weight on the non-parametric test results as the Jarque Bera test statistics show that most variables have a non-normal distribution.

Overall, the results show that the switch to anonymous trading has been associated with a deterioration in liquidity, proxied by bid/ask spreads, particularly for small cap stocks. However the contemporaneous rise in volatility and reduction in stock prices will themselves tend to put upward pressure on percentage bid/ask spreads so it is not clear if the rise in percentage bid/ask spreads is attributable to the change in market architecture. We need to conduct some form of multivariate analysis to control for the simultaneous changes in volatility and stock price levels.

4.1.2 Multivariate analysis

We use a standard spread regression model to control for the influence of extraneous factors on bid/ask spreads. The model has the following form:

$$PBAS_{i,t} = \beta_0 + \beta_1 VAR_{i,t} + \beta_2 TVOL_{i,t} + \beta_3 INVPR_{i,t} + \beta_4 DUM_{i,t} + u_{i,t} \qquad (1)$$

where $PBAS_{i,t}$ is the percentage bid/ask spread on stock i on day t, $VAR_{i,t}$ is the volatility of the price of stock i on day t, $TVOL_{i,t}$ is the natural logarithm of trading volume on stock i on day t, $INVPR_{i,t}$ is the inverse of the price of stock i on day t, DUM_t is a dummy variable that take the value 0 prior to the introduction of anonymous trading and 1 thereafter and $u_{i,t}$ is random error term. Prior research shows that $\beta_1 > 0$, $\beta_2 < 0$ and $\beta_3 < 0$ (Comerton-Forde et al., 2005).

Table 2 reports the pooled estimation results for the regression model for sample periods of varying width centred on July 27, 2007 using OLS, fixed effects OLS and 2SLS. The OLS regression results reported in Panel A show that the estimates of β_1, β_2 and β_3 have the expected sign in all three sample periods. This shows that percentage bid/ask spreads are increasing in volatility and the inverse stock price and decreasing in trading volume, consistent with prior research (Comerton-Forde et al., 2005). The

estimates of β_4 are positive and significant at the 0.001 level for the narrowest sample period. The size and significance of β_4 then declines as the sample period widens. This indicates that the impact of the introduction of anonymous trading is time-varying.

[insert Table 2 here]

Panel B reports the regression results of the fixed effects OLS model. The specific intercept for each stock under the fixed effect estimation method is not reported. The estimation results are similar to those reported in Panel A: the estimates of β_1, β_2 and β_3 have the expected sign in all three sample periods. In addition, the estimates of β_4 have a positive sign and the size and significance of the estimates decline as the sample period widens.

Panel C reports the regression results of the 2SLS model. In the first stage of this procedure the natural logarithm of trading volume is regressed on lagged spreads and the natural log of market capitalisation. In the second stage the predicted level of trading volume is included in place of actual trading volume. Consistent with findings in Panels A and B, we find that the estimates of β_1, β_2 and β_3 all have the expected sign. Furthermore, the estimates of β_4 are positive and the size and significance of the estimates decline as the sample period widens.

Overall, the results across all three estimation methods show that the impact of the switch to anonymous trading is time-varying.[5] Accordingly, we modify equation (1) to allow us to measure the impact of the switch to anonymity on spreads in three separate 20-day windows in the post-event period – [+1,+20], [+21,+40] and [+41,60].

The modified regression model is:

[5] We obtain similar results when we use the value of shares traded as the measure of trading activity.

$$PBAS_{i,t} = \beta_0 + \beta_1 VAR_{i,t} + \beta_2 TVOL_{i,t} + \beta_3 INVPR_{i,t} + \beta_4 DUM1_{i,t} + \beta_5 DUM2_{i,t} + \beta_6 DUM3_{i,t} + u_{i,t} \quad (2)$$

where $PBAS_{i,t}$, $VAR_{i,t}$, $TVOL_{i,t}$ and $INVPR_{i,t}$ are as previously defined, $DUM1_t$ is a dummy variable that takes the value 1 in the period [+1,+20] and zero otherwise, $DUM2_t$ is a dummy variable that takes the value 1 in the period [+21,+40] and zero otherwise, $DUM3_t$ is a dummy variable that takes the value 1 in the period [+41,+60] and zero otherwise and $u_{i,t}$ is random error term

[insert Table 3 here]

Table 3 reports the estimates of β_4 and β_5 and β_6 for each of the three estimation methods (OLS, fixed effects and 2SLS). Across all three methods the coefficient on β_4 is significantly positive, suggesting an increase in the percentage bid-ask spread for the stocks in the sample over the window period [+1,+20] immediately following the introduction of broker anonymity. The average of the three coefficients on β_4 is 0.0020. The average stock price during the period [-60,-1] is $4.44 (see Table 1). It follows that the immediate impact of the introduction of anonymous trading is a rise in the average bid/ask spread of approximately 0.89 cents (equals $4.44 x 0.0020) during the post-event period [+1,+20].

For the period [+21,+40] following the introduction of broker anonymity, none of the estimates of β_5 are significantly different from zero. The average value of β_5 is 0.0001, implying that average percentage spreads are 0.0001 or only 0.01% higher due to the introduction of anonymous trading during the second period.

In the period [+41,+60] following the introduction of broker anonymity, the estimates of β_6 are significantly negative under both the OLS and fixed effects models. The average estimate of β_6 for all three models is -0.0006 or 0.06%.

The results reported above suggests that the introduction of anonymous trading temporarily increased the adverse selection risk faced by limit order traders – liquidity providers – who in turn moved to protect themselves by widening the bid/ask spread. A time passed, however, it appears that the perception of increased adverse selection abated and spreads declined below their pre-anonymity levels. After three months the typical bid/ask spread had declined by approximately 0.27 cents (equals \$4.44 x -0.0006). An effective spread of half this amount translates to a reduction in transaction costs of \$1.7 million on annual turnover of \$25 billion. This represents the decrease in compensation limit order traders demand for supplying liquidity in an environment with anonymous trading.

[insert Table 4 here]

We now estimate the spread regression models represented by equations (1) and (2) separately for the large-cap, medium-cap and small-cap subsamples to determine whether the behaviour of bid/ask spreads observed above is independent of stock capitalisation. This estimation is conducted using OLS since results reported above in Tables 2 and 3 suggest that OLS yields similar results to those produced by fixed effects OLS and 2SLS.

The estimated results for equation (1) are reported in Table 4. The results reported in all three panels show that the estimates of β_4 are generally larger and more significant for the shorter sample periods. The time-varying nature of the estimates of β_4 is consistent

with the results reported in Table 2. Furthermore the magnitude of the estimates of β_4 for the narrowest sample period is higher for small-cap stocks. To some extent, this is to be expected since lower cap stocks have higher spreads to begin with, in part reflecting a combination of lower trading volume and lower stock prices. Nonetheless, the increase in spreads appears disproportionate for small cap stocks.

[insert Table 5 here]

Table 5 reports OLS estimation results for equation (2) for the three capitalisation-based subsamples. The estimates of β_4 are significantly positive for all three subsamples. The size of the coefficient on β_4 also increases from large to small capitalisation stocks, suggesting that the increase in the bid-ask spread in this post switch period [+1,+20] was more pronounced for small stocks. Similar to the results in Table 3, none of the estimates of β_5 are significant. Estimates of β_6 are significantly negative (-0.0007) for only the medium-cap sample of stocks. Overall, the results reported in Table 5 show that the improvement in liquidity observed in Table 3 is concentrated in medium-cap stocks. The introduction of anonymous trading appears to have had no significant effect on the liquidity of large-cap and small-cap stocks.

The positive implications of anonymous trading for liquidity, in particular for the sample of mid cap stocks, are consistent with the arguments of Simaan et al. (2003 and Foucault et al. (2007 that anonymity should reduce bid/ask spreads by encouraging the submission of more aggressive limit orders and competitive quotes. That is broker anonymity enables informed investors to disguise the information they possess and prevent free-riding by uninformed traders.

4.2 NZX's market share in cross-listed stocks

Table 6 reports data on the NZX's share of on-market trading in 13 stocks that have their primary listing on the NZX but are also listed on the ASX. We compute the average daily NZX market share during the transparent [-60,-1] and anonymous [+1,+60] periods and use the *t*-test and Wilcoxon test statistics to test the null hypothesis that the NZX's market share is unchanged. The 13 stocks are listed in descending order of market capitalisation.

[insert Table 6 here]

The results reported in Table 4 show that the change in the NZX's daily market share is significant for only five of the 13 stocks examined. The change in market share is positive and significant in four stocks - TEL records a median rise of 0.0523 or 5.23%, GPG a median rise of 0.1259 or 12.59%, FPH a median rise of 0.0436 or 4.36% and FPA a median rise of 0.0815 or 8.15% - and negative and significant for one stock - NZO recording a fall of 0.0905 or 9.05%. These results provide only very weak support for the notion that the adoption of anonymous trading would improve the NZX's market share of trading volume in cross-listed stocks.

5. Summary

This paper examines the impact of the NZX's switch to anonymous trading in late July 2007. Our univariate analysis shows that bid/ask spreads are higher in the immediate post-event period. Regression analysis reveals that spreads initially rise but then decline as time passes and eventually fall below the pre-event levels. This decline is most pronounced for the sample of mid cap stocks. The results show that liquidity providers' initial fears of greater adverse selection risk are not realised. We find, however, there is only weak evidence that the switch to anonymous trading increases the NZX's share of on-market trading volume in NZX-listed stocks that are cross-listed on the ASX.

Overall, our results suggest that the introduction of anonymous trading on the NZX yielded modest benefits for investors and the NZX. For example, the benefit of lower spreads to liquidity demanders is in the order of $1.7 million per $25 billion of turnover.

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Table 1
Summary statistics on key variables

	Full sample		Large cap sample		Medium cap sample		Small cap sample	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Bid-ask spread								
Pre-event	0.0081	0.0070	0.0052	0.0040	0.0074	0.0070	0.0114	0.0100
Post-event	0.0090	0.0070	0.0058	0.0050	0.0076	0.0070	0.0132	0.0110
Difference	0.0010	0.0000	0.0006	0.0010	0.0003	0.0000	0.0018	0.0010
Test statistic	4.73***	3.58***	3.26**	1.93	1.40	1.08	4.04***	3.87***
Volatility								
Pre-event	0.0141	0.0110	0.0147	0.0120	0.0149	0.0120	0.0128	0.0100
Post-event	0.0160	0.0130	0.0179	0.0150	0.0152	0.0140	0.0151	0.0110
Difference	0.0020	0.0020	0.0032	0.0030	0.0003	0.0020	0.0023	0.0010
Test statistic	4.88***	7.51***	4.03***	6.51***	0.42	2.88**	3.75***	4.09***
Trading volume								
Pre-event	483,143	113,999	1,095,081	440,086	287,695	134,585	118,408	29,522
Post-event	468,096	109,250	1,097,242	415,905	275,958	145,549	84,514	25,867
Difference	-15,047	-4,749	2,161	-24,181	-11,737	10,964	-33,894	-3,655
Test statistic	0.41	1.29	0.02	0.58	0.54	0.49	2.89**	1.88
Price								
Pre-event	$4.44	$3.77	$5.61	$4.99	$3.92	$3.66	$3.88	$3.21
Post-event	$4.25	$3.46	$5.46	$4.61	$3.65	$3.32	$3.72	$2.81
Difference	-$0.19	-$0.31	-$0.16	-$0.38	-$0.37	-$0.35	-$0.15	-$0.40
Test statistic	2.37*	3.41***	1.04	1.89	2.45*	2.84*	1.13	2.75**

The pre-event period is from May 3, 2007 to July 27, 2007. The post-event period is from July 30, 2007 to October 18, 2007. The percentage bid/ask spread is measured by the relative time-weighted average bid/ask spread divided by the time-weighted price. Intraday volatility is computed as the daily average of the differences between the logarithms of the daily highest and lowest stock prices. Trading volume is measure by the volume of shares traded. Price is measured by the time-weighted price. The null hypothesis of no change between the pre-event and post-event level of a variable is tested using the t-test and Wilcoxon signed rank test.

Table 2
Estimation results for equation (1) - full sample

	Constant	VAR	LN(TVOL)	INVPR	DUM	Adj. R^2
Panel A: OLS						
[-20,+20]	0.0260	0.1148	-0.0020	0.0088	0.0022	0.244
	15.01***	4.34***	-11.89***	6.13***	3.92***	
[-40,+40]	0.0244	0.1168	-0.0018	0.0081	0.0008	0.244
	20.38***	6.66***	-16.13***	9.16***	2.41*	
[-60,+60]	0.0225	0.1017	-0.0016	0.0078	0.0004	0.235
	23.46***	6.86***	-18.42***	11.03***	1.64	
Panel B: OLS, fixed effects						
[-20,+20]	0.0040	0.0977	-0.0004	0.0246	0.0018	0.361
	1.62	3.92***	-2.00*	2.85**	4.20***	
[-40,+40]	0.0082	0.0978	-0.0005	0.0105	0.0008	0.338
	4.34***	5.93***	-3.49**	2.07*	2.86***	
[-60,+60]	0.0071	0.0878	-0.0004	0.0090	0.0005	0.326
	4.76***	6.36***	-3.55***	2.55*	2.17*	
Panel C: 2SLS						
[-20,+20]	0.0452	0.0681	-0.0033	0.0013	0.0020	0.245
	13.47***	3.06**	-12.23***	0.87	3.63***	
[-40,+40]	0.0440	0.0722	-0.0032	0.0011	0.0009	0.250
	18.93***	5.03***	-17.03***	1.16	2.61**	
[-60,+60]	0.0404	0.0770	-0.0029	0.0012	0.0005	0.246
	21.09***	6.20***	-18.89***	1.64	1.82	

The dependent variable is $PBAS_{i,t}$, the percentage bid/ask spread on stock i on day t, $VAR_{i,t}$ is the volatility of the price of stock i on day t, $LN(TVOL_{i,t})$ is the natural logarithm of trading volume on stock i on day t, $INVPR_{i,t}$ is the inverse of the price of stock i on day t, DUM_t is a dummy variable that take the value 0 prior to the introduction of anonymous trading and 1 thereafter.
*** Significant at the 0.001level. ** Significant at the 0.01 level. * Significant at the 0.05 level.

Table 3
Estimation results for equation (2) – full sample

	DUM1	DUM2	DUM3
OLS	0.0021	-0.0001	-0.0007
	4.09***	-0.28	-2.29*
Fixed effects OLS	0.0021	0.0001	-0.0006
	4.78***	0.33	-2.29*
2SLS	0.0019	0.0002	-0.0006
	3.86***	0.53	-1.66

$DUM1_t$ is a dummy variable that takes the value 1 in the period [+1,+20] and zero otherwise, $DUM2_t$ is a dummy variable that takes the value 1 in the period [+21,+40] and zero otherwise, $DUM3_t$ is a dummy variable that takes the value 1 in the period [+41,+60] and zero otherwise.
*** Significant at the 0.001level. ** Significant at the 0.01 level.
* Significant at the 0.05 level.

Table 4
OLS estimation results for spread regression model - capitalisation-based subsamples

	Constant	VAR	LN(TVOL)	INVPR	DUM	Adj. R^2
Panel A: Large cap stocks						
[-20,+20]	0.0158	0.0823	-0.0010	0.0047	0.0010	0.209
	8.96***	2.45*	-6.84***	3.50***	2.57*	
[-40,+40]	0.0157	0.0545	-0.0010	0.0042	0.0006	0.184
	11.93***	3.15**	-9.27***	4.49***	2.28*	
[-60,+60]	0.0161	0.0464	-0.0010	0.0042	0.0004	0.193
	15.12***	3.99***	-12.02***	5.25***	1.57	
Panel B: Medium cap stocks						
[-20,+20]	0.0123	0.0686	-0.0007	0.0048	0.0017	0.153
	5.64***	3.30***	-3.18**	4.90***	4.27***	
[-40,+40]	0.0132	0.0875	-0.0007	0.0047	0.0003	0.122
	8.51***	5.16***	-5.16***	7.24***	1.12	
[-60,+60]	0.0116	0.0634	-0.0006	0.0046	0.0001	0.108
	9.45***	3.09**	-5.14***	9.10***	0.58	
Panel C: Small cap stocks						
[-20,+20]	0.0293	0.1530	-0.0022	0.0078	0.0036	0.118
	8.60***	2.98**	5.94***	3.31***	2.81**	
[-40,+40]	0.0259	0.1737	-0.0019	0.0067	0.0015	0.114
	10.74***	5.59***	-7.23***	4.49***	2.01**	
[-60,+60]	0.0235	0.1886	-0.0017	0.0062	0.0009	0.114
	12.76***	7.02***	-8.29***	5.22***	1.43	

The dependent variable is $PBAS_{i,t}$, the percentage bid/ask spread on stock i on day t, $VAR_{i,t}$ is the volatility of the price of stock i on day t, $LN(TVOL_{i,t})$ is the natural logarithm of trading volume on stock i on day t, $INVPR_{i,t}$ is the inverse of the price of stock i on day t, DUM_t is a dummy variable that take the value 0 prior to the introduction of anonymous trading and 1 thereafter.
*** Significant at the 0.001level. ** Significant at the 0.01 level. * Significant at the 0.05 level.

Table 5
OLS estimation results for equation (2) – capitalisation-based subsamples

	DUM1	DUM2	DUM3
Large cap	0.0011	0.0001	-0.0001
	3.01***	0.31	-0.21
Medium cap	0.0013	-0.0002	-0.0007
	3.78***	-0.66	-2.78**
Small cap	0.0037	0.0000	-0.0011
	3.09**	0.06	-1.68

$DUM1_t$ is a dummy variable that takes the value 1 in the period [+1,+20] and zero otherwise, $DUM2_t$ is a dummy variable that takes the value 1 in the period [+21,+40] and zero otherwise, $DUM3_t$ is a dummy variable that takes the value 1 in the period [+41,+60] and zero otherwise.
*** Significant at the 0.001level. ** Significant at the 0.01 level.
* Significant at the 0.05 level.

Table 6
NZX market shares in cross-listed stocks

		Mean	Median	*t*-statistic	Wilcoxon
TEL	Pre-event	0.4030	0.4483		
	Post-event	0.5715	0.5006		
	Difference	0.1685	0.0523	4.55***	3.47***
FBU	Pre-event	0.7051	0.7285		
	Post-event	0.7273	0.7463		
	Difference	0.0222	0.0178	0.76	0.83
AIA	Pre-event	0.9220	0.9523		
	Post-event	0.9020	0.9408		
	Difference	-0.0200	-0.0115	-1.17	1.31
AIR	Pre-event	0.8267	0.8936		
	Post-event	0.8640	0.8930		
	Difference	0.0372	-0.0006	1.47	0.43
SKC	Pre-event	0.8550	0.9068		
	Post-event	0.8731	0.9094		
	Difference	0.0181	0.0026	0.72	0.35
SKT	Pre-event	0.9418	1.0000		
	Post-event	0.9683	1.0000		
	Difference	0.0265	0.0000	0.92	0.45
GPG	Pre-event	0.6415	0.6445		
	Post-event	0.7572	0.7704		
	Difference	0.1156	0.1259	4.28***	3.79***
WHS	Pre-event	0.9132	0.9787		
	Post-event	0.9472	0.9976		
	Difference	0.0340	0.0189	1.53	1.87
FPH	Pre-event	0.8635	0.8949		
	Post-event	0.9142	0.9385		
	Difference	0.0506	0.0436	2.96**	3.03***
FPA	Pre-event	0.8079	0.8624		
	Post-event	0.8533	0.9439		
	Difference	0.0454	0.0815	1.35	2.73***
NPX	Pre-event	0.9795	1.0000		
	Post-event	0.9694	1.0000		
	Difference	-0.0101	0.0000	-0.98	0.56
TWR	Pre-event	0.4005	0.3709		
	Post-event	0.3810	0.3945		
	Difference	-0.0195	0.0236	-0.64	0.41
NZO	Pre-event	0.8374	0.8874		
	Post-event	0.7626	0.7969		
	Difference	-0.0748	-0.0905	-2.58*	2.84**

*** Significant at the 0.001level. ** Significant at the 0.01 level. * Significant at the 0.05 level.

Appendix

Large-cap stocks		Medium-cap stocks		Small-cap stocks	
Stock code	Mkt Cap ($m)	Stock code	Mkt Cap ($m)	Stock code	Mkt Cap ($m)
TEL	9,494	IFT	1,386	TWR	460
FBU	6,271	KIP	1,102	STU	418
CEN	5,461	RYM	1,075	SAN	393
AIA	4,056	FPA	1,009	MHI	358
AIR	2,650	POT	927	NZO	325
VCT	2,650	APT	742	PFI	296
TPW	2,617	MFT	727	HLG	281
SKC	2,217	ING	634	NZX	279
SKT	2,175	RAK	619	RBC	254
GPG	1,919	PPL	575	THL	245
NZR	1,908	NPX	548	CAV	210
WHS	1,888	FRE	519	EBO	178
FPH	1,663	PGW	509	HBY	166
				MVN	163
				SKL	96

Market capitalisation as at July 27, 2007.
Stocks in the NZX50 Index at July 27, 2007but excluded from the analysis (with market capitalisation in brackets) are APN ($1,483m), GFF ($1,336m), GMT ($905m), WBC ($871m), ANZ ($589m), AMP ($456m), LNN ($216m), IMP ($184m), TLS ($120m).